[0060] What is claimed as new and desired to be protected by Letters Patent of the United States is:

1. A method of forming at least one region of a second material in a first solid material, said method comprising the steps of:

forming at least one hole in said first solid material;

filling said at least one hole with a second material different from said first solid material, said second material being characterized by a melting temperature lower than the melting temperature of said first solid material; and

heating said first solid material and said second material to form at least one region filled with said second material, said at least one region being formed within, and surrounded by, said first solid material.

2. The method of claim 1, wherein said act of filling said at least one hole with said second material further comprises the act of immersing said first solid material in a melt of said second material at a first temperature, said melt being characterized by a melting temperature lower than the melting temperature of said first solid material, and subsequently increasing said first temperature of said melt to form said at least one region filled with said second material.

3. The method of claim 2 further comprising the step of removing said first solid material from said melt after said step of forming said at least one region filled with said second material.

4. The method of claim 1, wherein said act of filling said at least one hole with said second material further comprises the act of depositing said second material in said at least one hole and subsequently increasing the temperature of said first solid material and of said second material to form said at least one region filled with said second material.

5. The method of claim 4, wherein said act of depositing said second material includes chemical vapor deposition.

6. The method of claim 4, wherein said act of depositing said second material includes plasma enhanced chemical vapor deposition.

7. The method of claim 1, wherein said at least one region has a spherical configuration.

8. The method of claim 1, wherein said at least one region has a plate-shaped configuration.

9. The method of claim 1, wherein said at least one region has a pipe-shaped configuration.

10. The method of claim 1, wherein said at least one region comprises at least one sphere-shaped region.

11. The method of claim 1, wherein said first solid material is selected from the group consisting of aluminum, germanium, silicon and silicon dioxide.

12. The method of claim 1, wherein said second material is aluminum and said first solid material is selected from the group consisting of germanium, silicon and silicon dioxide.

13. The method of claim 1, wherein said second material is germanium and said first solid material is selected from the group consisting of silicon and silicon dioxide.

14. The method of claim 1, wherein said second material is silicon and said first solid material is silicon dioxide.

15. The method of claim 1, wherein said at least one hole is a cylindrical hole.

16. A method of forming at least one region of a second material in a first solid material, said method comprising the steps of:

forming at least one hole in said first solid material;

immersing said first solid material in a melt of said second material at a first temperature, said melt being characterized by a melting temperature lower than the melting temperature of said first solid material, and filling said at least one hole with said melt of said second material; and

subsequently increasing said first temperature of said melt to form at least one region filled with said second material, said at least one region being formed within, and surrounded by, said first solid material.

17. The method of claim 16, wherein said at least one region has a spherical configuration.

18. The method of claim 16, wherein said at least one region has a plate-shaped configuration.

19. The method of claim 16, wherein said at least one region has a pipe-shaped configuration.

20. The method of claim 16 further comprising the step of removing said first solid material from said melt after said step of forming said at least one region.

21. The method of claim 16, wherein said at least one hole is a cylindrical hole.

22. A method of forming at least one spatial region of a second material in a first solid material, said method comprising the steps of:

forming at least one hole in said first solid material;

depositing said second material in said at least one hole, said second material being characterized by a melting temperature lower than the melting temperature of said first solid material, and filling said at least one hole with said second material; and

subsequently increasing the temperature of said first solid material and of said second material to form at least one spatial region filled with said second material, said at least one spatial region being formed within, and surrounded by, said first solid material.

23. The method of claim 22, wherein said act of depositing said second material includes chemical vapor deposition.

24. The method of claim 22, wherein said act of depositing said second material includes plasma enhanced chemical vapor deposition.

25. The method of claim 22, wherein said at least one spatial region has a spherical configuration.

26. The method of claim 22, wherein said at least one spatial region has a plate-shaped configuration.

27. The method of claim 22, wherein said at least one spatial region has a pipe-shaped configuration.

28. The method of claim 22, wherein said at least one hole is a cylindrical hole.

29. A method of modifying the energy band characteristics of an atomic lattice of a first solid material, comprising the act of forming at least one unit cell beneath a surface of, and within, said first solid material, said unit cell comprising a plurality of spatial regions of a second material arranged in a predefined pattern, said plurality of spatial regions of said second material being surrounded by said first solid material.

30. The method of claim 29, wherein said act of forming said plurality of spatial regions further comprises the act of forming at least one hole within said first solid material.

31. The method of claim 30, wherein said hole is a cylindrical hole.

32. The method of claim 30, wherein said act of forming said plurality of spatial regions further comprises the act of immersing said first solid material in a melt of said second material at a first temperature, said melt having a melting temperature lower than the melting temperature of said first solid material.

33. The method of claim 32, wherein the act of forming said plurality of spatial patterns further comprises the act of increasing said first temperature to a second temperature to form at least one spatial region filled with said second material, said at least one spatial region being formed within, and surrounded by, said first solid material.

34. The method of claim 30, wherein the act of forming said plurality of spatial regions further comprises the act of depositing said second material in said hole to fill said hole, said second material having a melting temperature lower than the melting temperature of said first solid material.

35. The method of claim 34, wherein the act of forming said plurality of spatial regions further comprises the act of increasing the temperature of said first and second materials to form at least one spatial region filled with said second material, said at least one spatial region being formed within, and surrounded by, said first solid material.

36. The method of claim 29, wherein said plurality of spatial regions act as diffraction centers for energy particles.

37. The method of claim 36, wherein said energy particles are electromagnetic waves.

38. The method of claim 36, wherein said energy particles are selected from the group consisting of microwaves, photons, X rays and gamma rays.

39. The method of claim 36, wherein said energy particles are light particles.

40. The method of claim 36, wherein said energy particles are magnetic waves.

41. The method of claim 36, wherein said energy particles are elastic waves.

42. The method of claim 36, wherein said energy particles are electrons.

43. The method of claim 36, wherein said energy particles are ions.

44. The method of claim 29, wherein at least one of said plurality of spatial regions has a pipe-shaped configuration.

45. The method of claim 29, wherein at least one of said plurality of spatial regions has a spherical configuration.

46. The method of claim 29, wherein at least one of said plurality of spatial regions has a plate-shaped configuration.

47. The method of claim 29, wherein said plurality of spatial regions are spheres.

48. The method of claim 47, wherein said spheres have similar radii.

49. The method of claim 47, wherein said spheres have different radii.

50. The method of claim 29, wherein said unit cell is a cubic cell.

51. The method of claim 29, wherein said first solid material is a magnetic material.

52. The method of claim 29, wherein said first solid material is a ferroelectric material.

53. The method of claim 29, wherein said first solid material is a piezoelectric material.

54. The method of claim 29, wherein said first solid material is selected from the group consisting of metals, semiconductors and insulators.

55. The method of claim 29, wherein said first solid material is a semiconductor.

56. A method of forming a space lattice in a first solid material, said method comprising the steps of:

forming a first plurality of cylindrical holes in said first solid material;

filling said first plurality of cylindrical holes with a second material different from said first solid material, said second material being characterized by a melting temperature lower than the melting temperature of said first solid material;

heating said first solid material and said second material to form a first plurality of spatial regions filled with said second material, said first plurality of spatial regions being formed within, and surrounded by, said solid material and below a surface of said solid material; and

forming a second plurality of cylindrical holes in said solid material, said second plurality of cylindrical holes being located parallel to said first plurality of spatial regions relative to said surface of said solid material.

57. The method of claim 56, wherein said act of filling said first plurality of cylindrical holes with said second material further comprises the act of immersing said first solid material in a melt of said second material at a first temperature, and subsequently increasing said first temperature of said melt to form said first plurality of spatial regions.

58. The method of claim 56, wherein said act of filling said first plurality of cylindrical holes with said second material further comprises the act of depositing said

second material in said first plurality of cylindrical holes, and subsequently increasing the temperature of said first solid material and of said second material to form said first plurality of spatial regions.

59. The method of claim 56 further comprising the act of filling said second plurality of cylindrical holes with said second material and subsequently heating said first solid material and said second solid material to form a second plurality of spatial regions filled with said second material, said second plurality of spatial regions being formed within, and surrounded by, said solid material and below a surface of said solid material.

60. The method of claim 59, wherein said act of filling said second plurality of cylindrical holes with said second material further comprises the act of immersing said first solid material in a melt of said second material at a first temperature, and subsequently increasing said first temperature of said melt to form said second plurality of spatial regions.

61. The method of claim 59, wherein said act of filling said second plurality of cylindrical holes with a second material further comprises the act of depositing said second material in said first plurality of cylindrical holes, and subsequently increasing the temperature of said first solid material and of said second material to form said second plurality of spatial regions.

62. The method of claim 59, wherein said first plurality of spatial regions form a first photonic band structure in said first solid material.

63. The method of claim 62, wherein said second plurality of spatial regions form a second photonic band structure in said first solid material.

64. The method of claim 63, wherein said first photonic band structure has identical characteristics to the characteristics of said second photonic band structure.

65. The method of claim 63, wherein said first photonic band structure has different characteristics than the characteristics of said second photonic band structure.

66. The method of claim 59, wherein said first and second plurality of spatial regions include a pipe-shaped region.

67. The method of claim 59, wherein said first and second plurality of spatial regions include a plate-shaped region.

68. The method of claim 59, wherein said first and second plurality of spatial regions include a sphere-shaped region.

69. The method of claim 59, wherein said first plurality of spatial regions is located below said second plurality of spatial regions relative to said surface of said first solid material.

70. The method of claim 59, wherein said first solid material is a monocrystalline substrate.

71. The method of claim 59, wherein said first solid material is selected from the group consisting of metals, semiconductors and insulators.

72. A solid material having spatial regions arranged therein in a predefined pattern, said spatial regions being surrounded by said solid material and providing said solid material with a predetermined energy particle diffraction pattern, said spatial regions comprising a material different from said solid material.

73. The solid material of claim 72, wherein said spatial regions include a pipe-shaped pattern.

74. The solid material of claim 72, wherein said spatial regions include a plate-shaped pattern.

75. The solid material of claim 72, wherein said spatial regions include a sphere-shaped pattern.

76. The solid material of claim 72, wherein said spatial regions are arranged in at least one unit cell pattern.

77. The solid material of claim 72, wherein said solid material is a monocrystalline substrate.

78. The solid material of claim 72, wherein said solid material is a magnetic material.

79. The solid material of claim 72, wherein said solid material is selected from the group consisting of insulators, semiconductors and metals.

80. The solid material of claim 72, wherein said solid material has a melting temperature higher than the melting temperature of said different material.

81. A semiconductor material having regions arranged within said semiconductor material in a periodic array, said regions being surrounded by said semiconductor material and having different particle diffraction patterns than said semiconductor material without regions, said regions comprising a material different from the material of said semiconductor material.

82. The semiconductor material of claim 81, wherein said regions include a pipe-shaped region.

83. The semiconductor material of claim 81, wherein said regions include a plate-shaped region.

84. The semiconductor material of claim 81, wherein said regions include a sphere-shaped region.

85. The semiconductor material of claim 81, wherein said periodic array includes at least one unit cell.

86. The semiconductor material of claim 85, wherein said unit cell is a body-centered cubic unit.